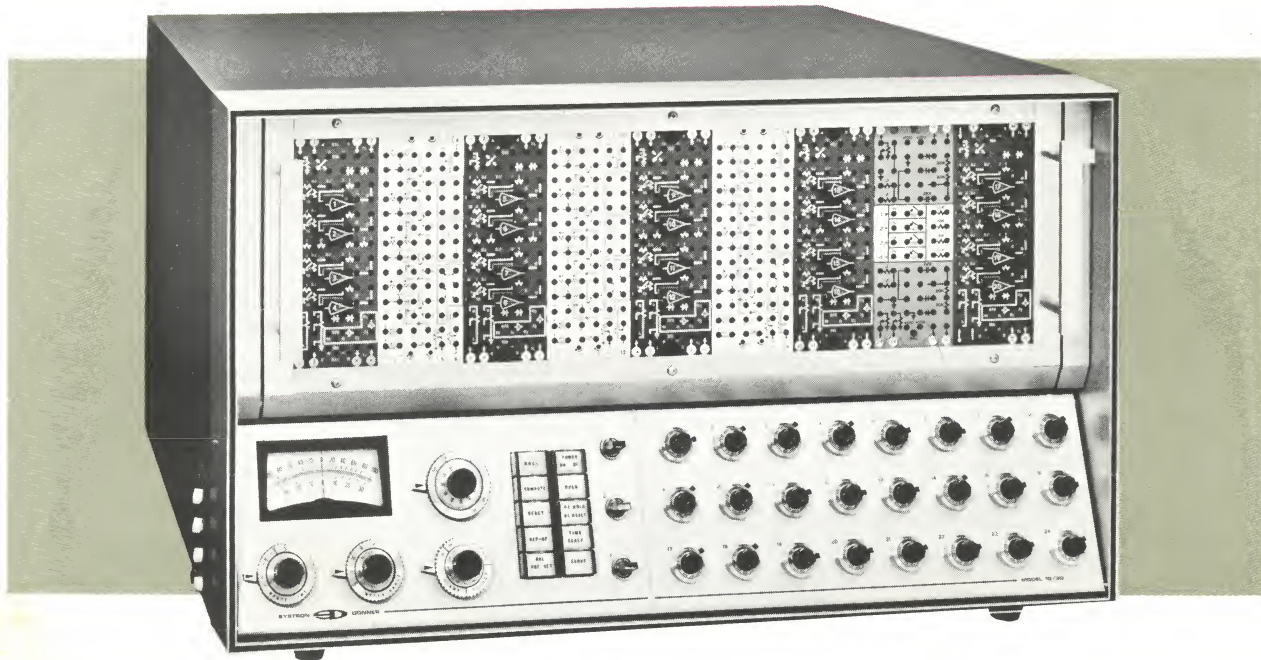


*Netz diode funktion traener.*

*New  
Portable  
Analog Computer*

# SD 10/20



## A MODERN $\pm 100$ VOLT COMPUTER

In 13 years since the first portable Donner computer was announced, over 1000 computers have been installed. Each year brought new improvements — chopper stabilized amplifiers, first classroom computer, first solid state  $\pm 100$  volt amplifiers, iterative computing mode, and others. Now the MODERN analog computer is available — the Systron-Donner 10/20.

Designed for the maximum in problem-solving capability in a small, expandable analog computer, the new SD 10/20 is the first true portable computer to offer a full  $\pm 100$  volt operating range. In addition to the basic 100 volt design, the SD 10/20 has been carefully engineered to match the larger, sophisticated computers in problem set-up,

checking and operation. This new computer thus brings to the engineering lab, classroom, and research facility the opportunity to utilize a small, portable computer that uses the same powerful solution approach to problems within the scope of analog computation as the big computers.

### DONNER'S EXPERIENCE LEADS THE WAY —

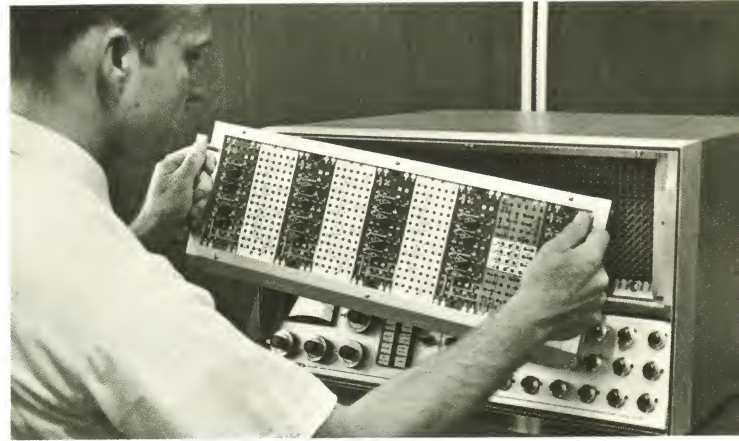
- ★  $\pm 100$  volt design, fully transistorized
- ★ Removable problem board with visual computer circuits
- ★ Patchable electronic mode control
- ★ Patchable integrator time scales
- ★ Full iterative controls, 100 cps REP-OP

**REMOVABLE PROBLEM BOARD**, consisting of color-coded modular panels, couples directly into computing modules which are housed in a universal, pre-wired patchbay. This close, direct coupling between patch terminals and computing modules provides decrease in amplifier cross-coupling and lower system noise.

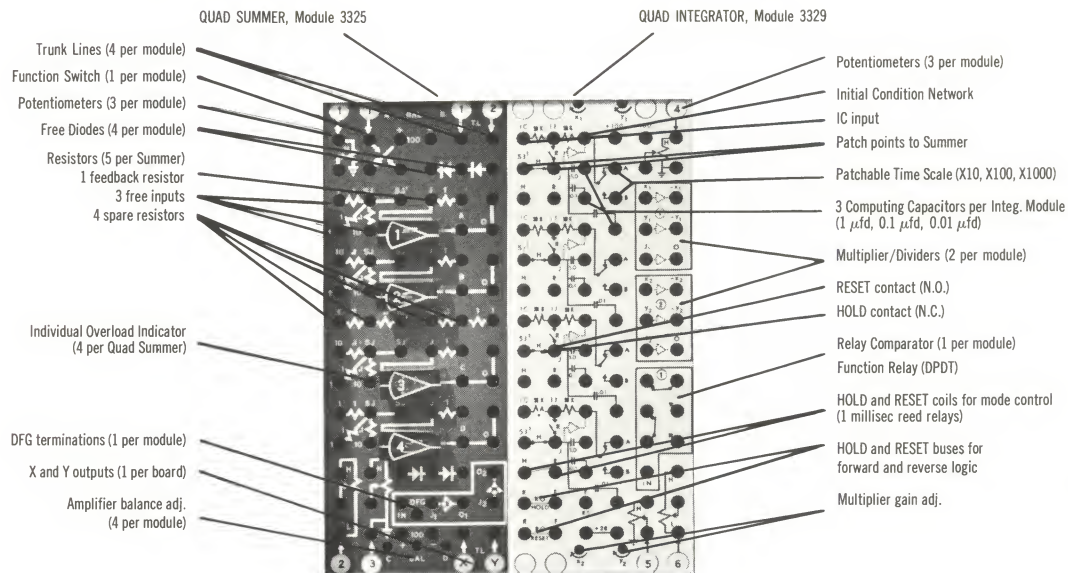
**VISUAL COMPUTER CIRCUIT.** All computer patch terminals are arranged into visual circuit diagrams thus matching the computer textbooks.

**CAPACITY** of 20 amplifiers, 16 integrators, 8 multipliers, 4 comparators, 24 potentiometers, and 4 variable diode function generators.

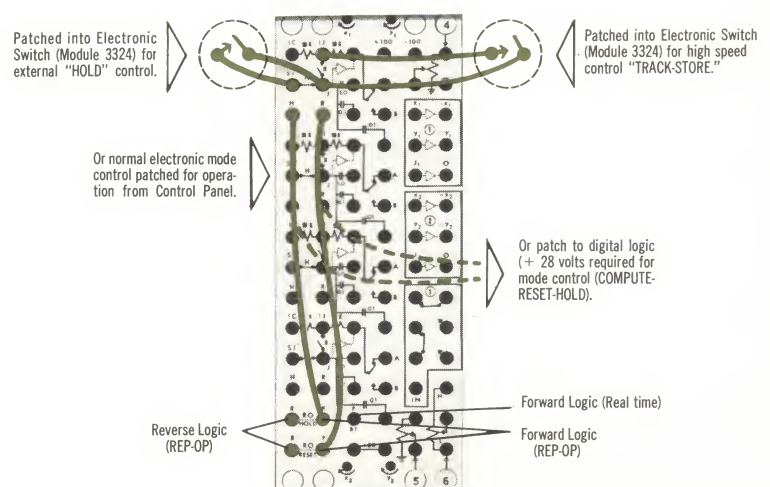
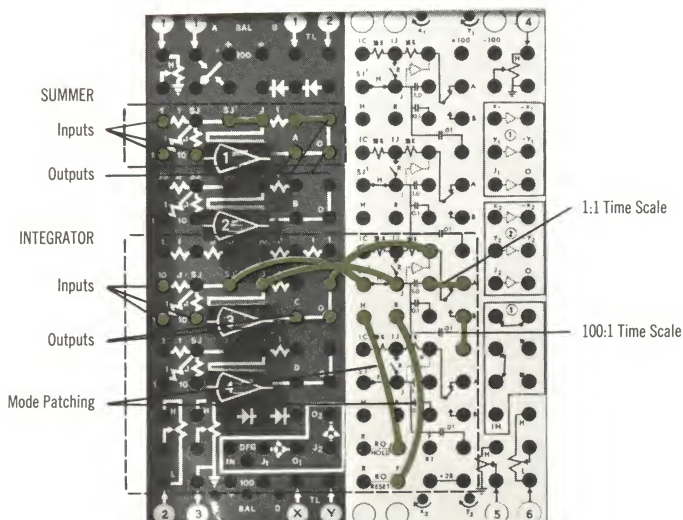
**FOOL-PROOF PROBLEM BOARD.** The power supply and all amplifiers are voltage and current limited. No blowing out of components when accidental shorts occur.



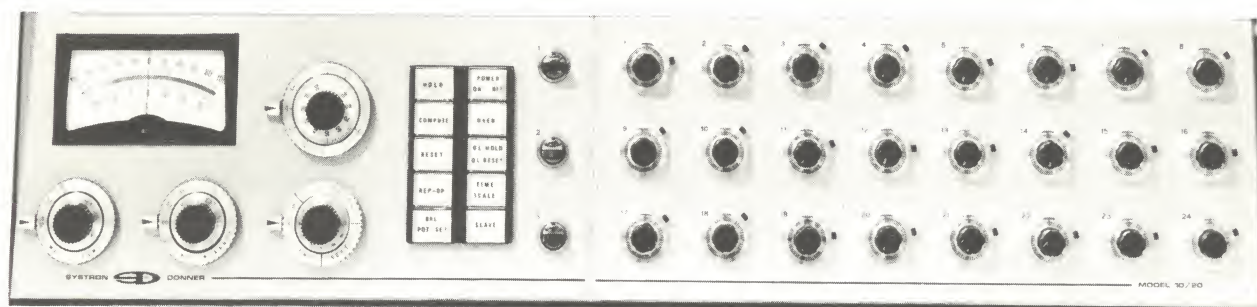
## BASIC COMPUTING MODULES



## SIMPLICITY AND FLEXIBILITY IN PATCHING COMPUTER CIRCUITS







## CONTROL PANEL

The SD 10/20 Control Panel puts at the operator's fingertips all the controls (pushbuttons, concentric selectors, switches) to facilitate rapid readout of problem variables, selection of

### MODE SELECTION—by lighted pushbuttons

**HOLD** — places problem solution on all integrators into hold position simultaneously (within 1 msec).

**COMPUTE** — applies problem voltages to all integrators simultaneously (within 1 msec).

**RESET** — applies initial condition voltages to integrators simultaneously (within 1 msec).

**REP-OP** — places integrators into a repetitive operation cycle. (Compute time variable from 5 msec to 10 sec.)

**BAL/POT SET** — disconnects junction and grounds the summing junction of all integrator and summer amplifiers. Each amplifier is converted to a gain of 2500 for accurate indication of junction offset.

**POWER ON/OFF** — energizes and de-energizes computer.

**OVEN** — indicates +28 volt oven power is on to maintain constant temperature of computing capacitors.

**OL HOLD, OL RESET** — lights up when any amplifier is overloaded. When depressed, computer goes into HOLD; when released, normal operation is resumed.

**TIME SCALE** — activates relays in each integrator module to change capacitor across amplifier. (x 10, x 100, x 1000, depending on patchpanel connections.)

**SLAVE** — permits operation of computer control circuitry from a second console.

### READOUT AND ADDRESS SELECTION

**PANEL METER** — for reading out amplifier outputs, potentiometer arms, potentiometer coefficients, and all mul-

tiplier and function generator outputs by selecting the appropriate amplifier. Meter reading ranges are 1, 3, 10, 30, 100, and 300 volts, and  $\pm$  null. Full scale accuracy is 2%. Null position provides 0.02% F.S. resolution with reference potentiometer having a  $\pm 0.05\%$  linearity at 25°C.

**ADDRESS SELECTOR** (concentric) — address capability of 20 amplifiers and 24 potentiometers.

**READOUT SELECTOR** (concentric) — provides rapid choice of readout at: Panel Meter, External (oscilloscope, x-y plotter, DVM), and +Null and -Null.

**METER RANGE SELECTOR** (concentric) — with positions for 300 v, 100 v, 30 v, 10 v, 3 v, and 1 v. Serves also as sensitivity adjustment for  $\pm$  null.

**COMPUTE TIME SELECTOR** (concentric) — compute time continuously variable 5 msec to 10 sec. Reset time varies from 5 msec to 5 sec, depending upon compute time selected.

### FUNCTION SWITCHES

Three single-pole, double throw switches, with terminations on the Quad Summer Modules, provide manual switching flexibility in problem solutions.

### POTENTIOMETER PANEL

Maximum capacity: 24 potentiometers, available in groups of 6. Choice of either 10-turn wire-wound potentiometers or single-turn carbon potentiometers for economy.



### VARIABLE DIODE FUNCTION GENERATOR GROUP

**FOUR VDFG CARDS** are mounted on a slide-out tray below the Control Panel. Each FG card contains 12 independent segments, all have screwdriver pot adjustment for break point and slope. Each FG channel terminates on a Quad Summer Module.

### TYPICAL EQUIPMENT COMPLEMENT

The Basic SD 10/20 is completely wired to accept a full complement of computing modules. Changing and expanding the module complement is accomplished merely by inserting additional computing modules (up to 9) into the pre-wired patchbay.

Item	Quantity
Cabinet with complete Control Panel, reference system, power supply, pre-wired patchbay	1
Quad Summers, Module 3325	5
Quad Integrators, Module 3329 (Dual Multiplier & Comparator)	4
Potentiometer Group, Model 3374 (6 potentiometers in each group)	4
Variable Diode Function Generators, Model 3351	4

## DUAL OPERATIONAL AMPLIFIER, Model 3310 (2 Model 3310 plug-in cards in each Module 3325 Quad Summer)

Maximum Output Voltage	$\pm 105$ volts (1 ma)
Output Voltage (at $\pm 25$ ma)	$\pm 100$ volts
Maximum Output Current (at $\pm 100$ v)	$\pm 25$ ma
Overall DC Gain	$> 10^7$
Summing Junction Offset	$< 100 \mu\text{V}/8$ hours

## INTEGRATORS (Part of Module 3329)

Reset Relays (Reed type) & Hold	Operate time 0.5 msec (typical) 1 msec (max) Differential operate time 0.2 msec (typical) 0.5 msec (max)
Integrator Drift ( $R_{in} = 1\text{M}$ , $C_{fb} = 1 \mu\text{f}$ )	$\pm 20 \mu\text{V}/\text{sec}$ max.
Noise at Output (with $C_{fb} = 1 \text{MF}$ )	$< 5$ mv (PP)

## SUMMERS (Module 3325)

Bandwidth ( $R_{in} = R_{fb} = 100\text{K}$ , no capacitive loading at summing junction or output)	$> 200$ kc (typical overshoot of 1.0 db)
Bandwidth ( $R_{in} = R_{fb} = 1\text{M}$ )	$> 50$ kc (typically no overshoot)
Velocity Limit	$> 3 \times 10^6$ v/sec
Noise at Output ( $R_{in} = R_{fb} = 1\text{M}$ with $R_{in}$ grounded)	10 mv (PP) (to 100 kc)
Phase shift at 100 cps ( $R_{in} = R_{fb} = 100\text{K}$ )	$< 0.03$

## INPUT & FEEDBACK COMPONENTS

Feedback capacitors of $1 \mu\text{f}$ and $0.1 \mu\text{f}$ values to within $\pm 0.02\%$ .
Feedback capacitors of $0.01 \mu\text{f}$ accurate to better than $\pm 1\%$ .
$1 \mu\text{fd}$ and $0.1 \mu\text{fd}$ capacitors mounted in an oven with $\pm 1$ degree C temperature regulation to reduce inherent dielectric changes with temperature.
Temperature coefficient of $0.01\%$ resistors less than $\pm 5$ ppm per degree C.
Input and feedback resistors matched to $\pm 0.01\%$ .

## QUARTER SQUARE MULTIPLIERS (Part of Module 3329)

Maximum static error: Less than 100 mv.
Zero Offset: $X = Y = 0 \rightarrow 20$ mv $X$ or $Y = 0 \rightarrow 60$ mv.
Frequency Response: Down no more than 3 db at 50 kc.
Drift: Less than 25 mv for 8 hours at constant temperature, $X = Y = \pm 100$ . Less than 5 mv/8 hours, $X = Y = 0$ .
Noise: 20 mv (PP) (0 to 100 kc).
Phase Shift: Less than $0.05^\circ$ at 100 cps and less than $0.5^\circ$ at 1000 cps.
Input and output signal voltage ranges: $\pm 100$ volts.

## DIODE FUNCTION GENERATORS, Model 3351

Noise: $< 100$ mv (PP) for worst possible conditions; high slope settings and all diodes conducting.
Amplitude Response: Flat to 1 kc.
Phase Shift: $< 1^\circ$ at 100 cycles (when using an operational amplifier output).
Input Impedance: $> 45\text{k ohm}$ .
Each function generator card has 12 diode segments (12 slopes and 12 break points). Two FG cards can be paralleled for 24-segment function generation.
Amplifiers required by the function generators are available at the patch board in the Quad Summer Modules. Each diode segment is capable of providing a 2:1 slope change.
Setting of the function is possible by adjusting the appropriate potentiometers while reading out the actual break point and ordinate values.

## COEFFICIENT POTENTIOMETERS, Model 3374

Linearity error	$< \pm 0.25\%$
Resolution	$< 0.013\%$
Power Rating	2.5 watts (at $40^\circ\text{C}$ )
End Resistance	$< 10$ ohms
Nominal Resistance	30k ohms

## PHYSICAL DESCRIPTION

Dimensions: 24" wide, 15" high, 25" deep.  
Weight: 125 lb. approx. (fully expanded).  
Power Consumption: 350 watts (fully expanded).  
Power Source: Connections provided for 115v, 220v, 230v, 240v, 250v,  $\pm 10\%$ , 50-400 cps.

## SYSTRON-DONNER ENGINEERING REPRESENTATIVES

### NORTH and CENTRAL ATLANTIC

**Burlingame Associates**  
510 South Fulton Avenue, Mount Vernon, New York  
Tel: MO 4-7530  
8218 Wisconsin Avenue, Washington 14, D.C.  
Tel: OL 4-6400  
106 Pickard Bldg., East Malloy Road, Syracuse 11, N.Y.  
Tel: 454-2408  
7 Wellington Street, Waltham, Massachusetts  
Tel: TW 4-1955  
222 Long Lane, Upper Darby, Pennsylvania  
Tel: JA 8-6080

### SOUTH ATLANTIC

**E. G. Holmes Associates**  
3667 Clairmont Rd., N.E., Chamblee, Georgia  
Tel: 451-6161  
316½ South Bumby Street, Orlando, Florida  
Tel: CH 1-2128  
430 W. Gaston St., Greensboro, North Carolina  
Tel: BR 2-9855  
915-F Franklin St. S.E., Huntsville, Alabama  
Tel: 539-1114

### MIDWEST

**S. Sterling Co.**  
21250 10½ Mile Rd., Southfield, Mich.  
Tel: 442-5656  
5827 Mayfield Rd., Cleveland 24, Ohio  
Tel: HI 2-8080  
3300 S. Dixie Dr., Dayton 39, Ohio  
Tel: AX 8-7573  
4232 Brownsville Rd., Pittsburgh 27, Penn.  
Tel: TU 4-5515  
7849 N. Lindberg Blvd., Hazelwood, Missouri  
Tel: TE 7-1221

**Carter Electronics**  
7203 So. Western Ave., Chicago 36, Illinois  
Tel: 776-1601  
2401 W. 66th St., Minneapolis 31, Minnesota  
Tel: 869-3261  
6333 Hollister Dr., Indianapolis 24, Indiana  
Tel: AX 3-0696

### WEST

**Ward-Davis Associates**  
2425 Mission St., San Marino, California  
Tel: 682-3307  
1020 Corporation Way, Palo Alto, California  
Tel: 968-7116  
3492 Pickett St., San Diego, California  
Tel: 297-4619  
**Barnhill Associates**  
1170 South Sheridan Blvd., Denver 26, Colorado  
Tel: 934-5505  
319-A Wyoming Blvd., N.E., Albuquerque, New Mexico  
Tel: 265-7766  
30 Pima Plaza, Scottsdale, Arizona  
Tel: 947-5493  
**Rush S. Drake Assoc.**  
6133 Maynard Avenue South, Seattle 8, Washington  
Tel: PA 5-2700

### CANADA

**Instronics, Ltd.**  
P. O. Box 100, Stittsville, Ontario, Canada  
Tel: 828-5115

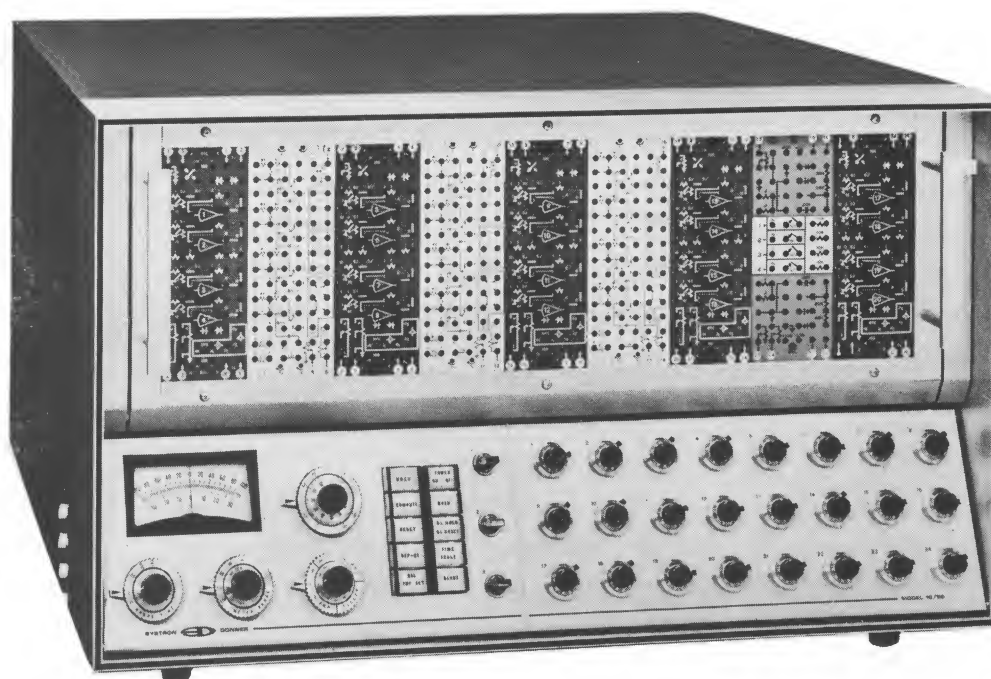
**SYSTRON  DONNER**  
CORPORATION

888 GALINDO STREET • CONCORD, CALIFORNIA  
Phone: (415) 682-6161 • TWX 415-687-3200



# TRANSISTORIZED $\pm 100V$ ANALOG COMPUTER PRICE and QUOTATION FORM

## SD 10/20



### **1** SD 10/20 COMPUTER

Cabinet with complete Control Panel, Potentiometer Panel (24 potentiometer capacity), pre-wired module receptacle (9 module capacity), computer power supply and  $\pm 100$  volt d.c. reference system.

OVERALL DIMENSIONS: 24" wide, 15" high, 25" deep      APPROX. WEIGHT: 100 lbs. (fully expanded)  
POWER CONSUMPTION: 150 watts (fully expanded)  
POWER SOURCE: Connections provided for 115v, 220v, 230v, 240v, 250v,  $\pm 10\%$ , 50-400 cps.

PRICE . . . . . \$ 3,000.00

	UNIT PRICE	QTY.	TOTAL PRICE
<b>1 BASIC SD 10/20 COMPUTER:</b>	\$3,000.00	_____	\$ _____
<b>2 POTENTIOMETER GROUP:</b>			
Model 3374 Pot group, 6 ten-turn wire-wound pots with counting dials	\$ 300.00	_____	\$ _____
_____			
Potentiometer TOTAL :	_____		
<b>3 FUNCTION GENERATOR GROUP:</b>			
Model 3351 Variable Diode Function Generator card	215.00	_____	\$ _____
Function Generator TOTAL: _____			
<b>4 COMPUTING MODULES:</b>			
Model 3325 Quad Summer	\$1,000.00	_____	\$ _____
Model 3329 Quad Integrator, Dual Multiplier & Comparator	750.00	_____	_____
Model 3320 Dual Integrator Amplifier	700.00	_____	\$ _____
Model 3321 Dual Summer Amplifier	650.00	_____	_____
Model 3322 Dual Inverter Amplifier and Dual Operational Relay	540.00	_____	_____
Model 3323 Dual Inverter Amplifier and Dual Electronic Multiplier	945.00	_____	_____
Model 3324 Dual Inverter Amplifier and Quad Electronic Switch	835.00	_____	_____
Model 3310 Dual Amplifier (spare card)	400.00	_____	_____
_____			
Computing Module TOTAL: _____ including _____ Amplifiers, _____ Summers, _____ Inverters, _____ Integrators, _____ Relay Comparators, _____ Electronic Comparators, _____ Multipliers			
<b>5 DIGITAL LOGIC CONTROL MODULES:</b>			
Model 3326 Flip-Flops	\$ 500.00	_____	\$ _____
Model 3327 Logic Gates	500.00	_____	_____
Model 3328 Time/Event Control	950.00	_____	_____
<b>6 Removable Problem Board</b>	120.00	_____	\$ _____
<b>7 Patch Cord and Shunt Plug Assortment (100 items)</b>	100.00	_____	_____
<b>8 Universal Module Extender</b>	100.00	_____	_____
<b>9 Instruction Manual, A.C. Power Cords and Spare Fuse Kit</b>		1 each	N/C
<b>10 Special Instructions or assembly requirements:</b>	_____		
_____			
_____			

Price for special work (if required) . . . . . \$ \_\_\_\_\_

**TOTAL PRICE, F.O.B. Concord, California** . . . . . \$ \_\_\_\_\_

S-D Quotation No: \_\_\_\_\_

(Please reference this number on all correspondence)

Delivery: \_\_\_\_\_ days after receipt of Purchase Order

Terms: net 30 days

**SYSTRON-DONNER CORPORATION**

**NOTE:** Budgetary prices are subject to change without notice. Signed quotations are firm for a period of 30 days.

Signature \_\_\_\_\_

Date \_\_\_\_\_